A Theory of the Proton-Electron Mass Ratio

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Abstract

A recent investigation by the author revealed that the proton-electron mass ratio could be extremely well approximated by the fourth root of an integer. In this paper, the author tries to account for this fact. This effort lead to a theory of nonreflexive distance at the subatomic scale which accounts for the difference in masses and their ratio. The theory is confirmed by accounting for the experimental radius of an electron.

The Proton-Electron Mass Ratio

Suppose the proton and electron are isotropic radiators (of some type of virtual particle). If the power of a transmitter T_x is denoted by P_t and if an isotropic radiator (transmitter which will radiate energy uniformly in all directions) then the power density at a distance R from the transmitter is equal to the radiated power divided by the surface area $4\pi R^2$ of an imaginary sphere of radius R, i.e., the power density at range R from an isotropic radiator is

$$= P_t/4\pi R^2 \quad \text{Watt/m}^2.$$

The target intercepts a portion of the incident energy and re-radiates it in all directions. It is only the power density re-radiated in the direction of the original transmitter (echo) that is of interest. The signal cross-section of the target determines the power density returned to the transmitter for a particular power density incident on the target. It is denoted by σ. The reradiated power returning back at the transmitter (now the receiver) is (1):

$$\frac{P_r}{\sigma_r} = \frac{P_t \sigma_t}{4\pi R^2 \cdot 4\pi R^2}.$$

The cross-section has units of area, but it can be misleading to associate the cross-section directly with the objects physical size. The cross-section is more dependent on shape than size.

Simple algebraic manipulation leads to:

$$R = \sqrt[4]{\frac{P_t}{P_r}\frac{\sigma_t\sigma_r}{(4\pi)^2}}$$

Now for an ansatz. Suppose that the distance from the proton to the electron $R_{p,e}$ does not equal the distance from the electron to the proton $R_{e,p}$ (the distance is nonreflexive) and that that discrepancy means that an equivalent amount of motion along equal arclengths would result in the traversal of different central angles (thus a difference in effective inertia), i.e.,

$$\frac{R_{p,e}}{R_{e,p}} = \sqrt[4]{\frac{P_{t,p}}{P_{r,p}} \cdot \frac{P_{r,e}}{P_{t,e}}} = \frac{m_p}{m_e}$$

If that were the case, the proton-electron mass ratio would be completely accounted for if it could be proven that

$$\frac{P_{t,p}}{P_{r,p}} \cdot \frac{P_{r,e}}{P_{t,e}} = 11,366,719,876,399$$

and that would essentially account for the proton-electron mass ratio by introducing a new constant of nature.

Suppose the theory is factual and further suppose $P_{t,p}/P_{t,e} = 1$, then we have

$$\frac{P_{t,p}}{P_{r,p}} \cdot \frac{P_{r,e}}{P_{t,e}} = \frac{\sigma_p}{\sigma_e}.$$

We can use this fact to solve for the approximate radius of the electron in the following way: The accepted value for the radius of a proton is $r_p = 8.4 \times 10^{-16}$ m, giving us a cross section $\sigma_p = \pi r_p^2 = 2.2167 \times 10^{-30}\,\mathrm{m}^2$ for the proton.

So we have

$$\frac{2.2167 \times 10^{-30}\,\mathrm{m}^2}{\sigma_e} = 11,366,719,876,399.$$

This gives

$$\sigma_e = \pi r_e^2 = 1.9501668 \times 10^{-43}\,\mathrm{m}^2$$

and we have

$$r_e = 2.49 \times 10^{-22}\,\mathrm{m}.$$

Note that experimentally, observation of a single electron in a Penning trap suggests the *upper limit* of the particle's radius to be about 10^{-22} meters (2).

References

1. Sharma, K.K., S.K. Kataria & Sons, *Introduction to Radar Systems.*

2. Dehmelt, H. (1988). "A Single Atomic Particle Forever Floating at Rest in Free Space: New Value for Electron Radius". *Physica Scripta.* T22: 102-110.